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# INSECT PHOTOGRAPHY.

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Photography is rapidly gaining in importance for record and descriptive purposes in scientific work. A good, clear photograph will convey much more to the reader of a text than pages of descriptive matter. Until recent years drawings have held priority as illustrative material, and perhaps still do, but with the rapid advance of photography photographs are assuming a leading role. Very few people are gifted with the ability to make rapid and accurate drawings and even with the best it is time-consuming, whereas almost anyone can learn to take good pictures. In a few cases when it is desired to show only certain characters in the form of a line drawing which is cheaper to reproduce than a photograph, a photograph can be inked in and the image bleached away. For the average person this is quicker and more accurate than drawing.

## HISTORICAL NOTES

Practical photography was invented by Fox Talbot, an Englishman, in 1834. He announced his invention to the Royal Society in 1839, a few days before Daguerre made an announcement of his processes to the French Academy. The slow, wet plates and poor lenses of those days were not adapted to photographing insects, and engraving processes were wholly inadequate to reproduce the results. In 1892 the first fairly good insect photographs were reproduced. This was due to the stimulation of Hatch who equipped a laboratory at Cornell University Experimental Station. Many insect photographs were taken in the next thirty years, but within the last few years great strides have been made in photographic equipment and materials.

## EQUIPMENT

The equipment for insect photography differs from that for birds and mammals in that we have to work close to our subjects and frequently require a magnified image on the original negative. Long focus and telephoto lenses are of relatively little use while they are the main standby of the photographer of larger animals. A good camera with double or triple extension bellows and ground glass is essential. This type of camera is now common and is as close to a universal purpose camera as is possible to obtain as it can be used in all kinds of scientific and pictorial work. The popular 9 by 12 cm. size is ideal. The lens should be a good anastagmat of F 4.5 aperture. With full bellows extension and supplementary lenses images of good magnification can be obtained. A view camera with a focusing back, as well as lens movement, is very useful for close-ups as in such cases it is easier to focus by moving the plate than the lens.

A tripod is absolutely essential to avoid movement. A good insect photograph can seldom be taken with a camera held in the hand. The telescopic metal tripod with ball and socket head is the best as it allows for adjustment

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to all heights and angles. An upright adjustable stand is very useful for laboratory work.

For laboratory photography where magnifications are required a micro-photographic camera is needed. This can be equipped with a set of microtessar lenses for low power work; or coupled to a microscope for higher powers. The amateur who only desires to take the occasional picture or cannot afford the more expensive commercial camera can do quite satisfactory work by setting up a long bellows camera with ground glass back on a homemade stand. Low magnifications can be secured with a short focus lens at full bellows extension. For higher magnifications, a microscope lens can be attached to the shutter of the camera by means of a collar. For rapid work with a microscope, light cameras can be secured which clamp to the eyepiece. Miniature cameras and small, roll film cameras with the focus set at infinity can be used in the same way. They are in focus when the microscope is in focus to the eye.

One of the most difficult problems connected with the photography of small insects is illumination. Goose-necked desk lamps placed on each side of the object, one closer than the other, give fairly good results but are difficult to adjust to get the right light and shade to throw structures into relief without getting confusing shadows. Shadows in the background can be eliminated by placing the object on a piece of glass suspended a few inches above an illuminated background. By far the best illumination can be secured by a circle of small lights about the lens set in a reflecting ring of metal, with an opal glass built into the bottom to diffuse the light. A neon tube can be used in the same manner and has the advantage of not giving off heat.

After one has acquired the necessary equipment and has located an insect he desires to photograph, the next consideration is exposure. This question is even more difficult to answer than in other branches of photography. One is working close to the subject and must give a short exposure to stop motion and yet must stop his lens down to get depth of focus. An exposure meter of the photo-electric type is practically a necessity. Even with it, one must make adjustments for bellows length, color of background, etc. In laboratory work one uses a constant source of illumination and the exposure, once determined, remains the same at given magnifications but has to be modified for color of object. Dark objects take nearly twice as long as light.

Film packs and cut films of the fastest types, such as superplenachrome and superpan, are necessary for photographing living insects and all subjects out of doors where there is danger of movement. They allow one to give a short exposure and yet use a small diaphragm to get depth of focus. For laboratory photography of dead or anaesthetized insects a slower film, such as commercial ortho or fine grained panchromatic, is preferable as it gives fine grain which permits of great enlargement.

A light yellow filter, such as K1, can be used to advantage in almost all cases.

Every scientific photographer should by all means learn to do his own developing, printing, and enlarging because his material needs special treatment that cannot be given by the "drug store" finisher. There is also a great saving in expense.

Fine grain developers should always be used as these permit of much greater enlargement and rendering of detail. Fine grain formulae, which come with the packets of film, are good. In general, follow the manufacturer's recommendation. Much research work is being done on developers and one frequently sees new formulae in photographic literature. Most developers use combinations of metol and hydroquinone but paraphenalinediamine is now coming into use in combination with glycerine and certain acids. This permits enlargement up to 30 diameters.

The possibilities of your negatives cannot be realized unless they are enlarged. It is often better to take the original photograph at a small magnification and then enlarge to the size desired. In this way one gains in depth of focus and can take his picture at a slower speed as movement is not so apt to blur the image. For enlarging, the camera that took the photograph is best. It can be attached to a home-made light box or to a similar manufactured box. It is a waste of money to buy a ready-built enlarger equipped with lens. The light box of a home-made enlarger can be made of wood or metal and should be approximately seven inches square and six inches in length. On top should sit a reflector which can be made out of one salvaged from an old automobile. This should have the central hole enlarged to take a standard light socket into which is placed a 150-watt bulb. By raising and lowering the socket, the best location for focus can be obtained. It can then be clamped in place. From four to five inches below the light a flange should be built, upon which a piece of opal glass is placed to diffuse the light. About three quarters of an inch below the opal glass a slot should be cut in which to insert the negative carrier which may be made of two pieces of glass hinged together with adhesive tape. Some attachment is then devised for fastening the camera (with the back removed) to the bottom of the light box. The enlarger is then complete except for attaching the light box by means of a short wooden arm to a vertical slide along which it may be raised and lowered. A weight attached to a cord and passed over a pulley at the top of the slide and attached to the arm of the light box will counterbalance the weight and aid in adjusting the height of the enlarger. The enlargement may be focused onto a table or easel upon which the sensitive paper is placed. The size of the enlargement is regulated by the distance of the camera from the easel and the focusing done with focusing adjustment on the camera. In enlarging one can dodge and shade during exposure to bring up certain parts of the picture and a certain amount of retouching can be done to the enlargement. It is generally better not to touch the negative. Enlargement onto glossy paper brings up greater detail and is easier to reproduce but is harder to retouch than a velvet or semimatt paper. It is preferred for purposes of reproduction.

### POSING THE SUBJECT

Live insects cannot be posed like a human but have to be photographed as we find them. It is best to approach them when they are occupied by feeding, egg-laying or some other occupation. Slow, careful movements do not frighten them. A sudden, quick movement will cause them to take fright. With patience much can be accomplished and with light movements of a stick they can frequently be manoeuvred into a desired location upon which the camera is focused.

A pinch or a jar will sometimes cause a caterpillar to assume a desired pose. Adult dragonflies can be posed by catching them and twisting their heads around a turn and a half to break the nerve cord. They will then cling to any object. Live insects reared or brought into the laboratory can often be arranged with a suitable background. Freshly killed insects can be arranged in a natural position with white or black backgrounds.

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## DESCRIPTIONS OF SOME GENERA AND SPECIES OF LEIODIDAE (COLEOPTERA).

BY W. J. BROWN,
Ottawa Ontario.

(continued from page 165)

### 6. Neocyrtusa insolita n. sp.

*Male.* Length 2.2 mm. Second and third antennal segments equal in length. Punctures of the pronotum evident, those of the elytral intervals very indistinct. Metasternum very indistinctly alutaceous near the lateral margin; the punctures fine and close at middle except on the impunctate area, a trifle coarser on the sides and there distinct but not deeply impressed, very closely placed, the punctures of the anterior margin like those of the disk. Each abdominal segment finely and closely punctate, without coarser punctures on the basal margin.

*Male characters*: Anterior tarsi feebly enlarged; middle tarsi more strongly so, slightly stouter than the posterior pair. Posterior femur with the hind margin not sinuate before the apex; the latter very broadly rounded, more broadly so than in females of the other species. Posterior tibia with the inner edge compressed, very acutely angulate in cross section. Median lobe of the aedeagus with the basal process reduced, attenuate apically, each dorsal and the ventral lobe of the median orifice narrowed to a very acute apex; internal sac without rod-like structures but with a group of spines on each side.

*Holotype.*— ♂, Penticton, B. C., May 16, 1936. (A. N. Gartrell); No. 4157 in the Canadian National Collection, Ottawa.

*Paratypes.*—3 ♂, same data; 3 ♂, Saskatoon, Sask., May 8, 1928, (K. M. King).

The paratypes measure from 2.2 to 2.7 mm. and exhibit no appreciable variotion in the secondary sexual characters. The middle tibiae are very distinctly arcuate in these specimens, showing that their secondary male characters are well developed and that larger males, if they occur, possess edentate posterior femora.

### 2. Anogdus Lec.

*Anogdus* Lec., 1866, Proc. Ac. Nat. Sci. Phila., 369.

Of this genus, I have seen only the type of *capitatus* Lec. (ibid), the species upon which the genus was based. The specimen is apparently a female and is from Florida. Another species, *Anogdus dissimilis* Blatch. (1916, Can. Ent. XLVIII, 93), was described from specimens taken at Dunedin, Fla.

### 3. Lionothus n. gen.

Body form as in *Neocyrtusa*. Head as in *Neocyrtusa* but with antennal grooves beneath. Antennae as in *Neocyrtusa* but with the club more elongate, its segments being less strongly transverse. Pronotum and elytra as in *Neocyrtusa*. Prosternum not carinate before the coxae. Mesosternum not carinate. Abdomen

with six distinct segments. Posterior tibia stouter at base than in *Neocyrtusa*.

*Male*. Anterior and middle tarsi, large spur of middle tibia, and posterior femur modified. Aedeagus much as in *Neocyrtusa* but the dorsal lobes of the median orifice lateral rather than dorso-lateral, well separated in dorsal aspect; the lateral lobes not joined together either dorsally or ventrally.

Type species—*Lionothus ulkei* n. sp.

### Lionothus ulkei n. sp.

*Cyrtusa blandissima* Horn, 1880, Trans. Am. Ent. Soc. VIII, 294 (*nec* Zimm., 1869, Trans. Am. Ent. Soc. 11, 250).

*Male*. Dark red. Length 2 mm. Second antennal segment very slightly longer than the third. Punctures of the pronotum quite evident; those of the elytral intervals less distinct. Metasternum polished; the punctures at its middle very fine; those on the sides moderately coarse, well impressed and defined, separated by distances subequal to their own diameters; the punctures on the anterior margin similar to those of the disk. Each abdominal segment with a basal row of very coarse, very deep punctures, virtually without other sculpture.

*Male characters*: Anterior tarsi feebly enlarged, the middle pair more strongly so. Middle tibia straight, the inner apical angle not produced; the longer spur flattened and bent suddenly near base. Lower condyle of posterior femur with a short, acute tooth, the femoral margin not sinuate before the tooth. Aedeagus as figured; each dorsal lobe of the median orifice parallel, very bluntly rounded at apex; internal sac with a very slender curved rod and other armature.

*Holotype*.— ♂, District of Columbia; in the Ulke Collection, Carnegie Museum, Pittsburgh, Pennsylvania.

*Allotype*.— ♀, same data.

*Paratypes*.—6 ♂, 5 ♀, same data; in the Ulke Collection, the collection of the Philadelphia Academy of Natural Science, and the Canadian National Collection. The paratypes measure from 1.7 to 2.2 mm. In some specimens, the metasternum is narrowly alutaceous and impunctate along the lateral margins. The femoral tooth is reduced but distinct in small males. As noted above, *Cyrtusa blandissima* Zimm. is a synonym of *Neocyrtusa obsoleta* Melsh.

## 4. Cyrtusa Er.

*Cyrtusa* Er., 1842, Arch. Naturg. VIII, 221.

Head very slightly more than half as wide as the pronotum; body a trifle less convex, the form otherwise as in *Neocyrtusa*. Antenna with the club a trifle more compact and the seventh segment relatively a trifle larger, otherwise as in *Neocyrtusa*. Prosternum strongly carinate before the coxae, the carina attaining the anterior margin. Mesosternum not carinate. Abdomen with six distinct segments.

*Male*. Secondary sexual characters as in *Neocyrtusa*.

Aedeagus with the median lobe arcuate, flattened dorso-ventrally except at base, incised at apex; the median orifice transverse. Lateral lobes joined dorsally by a very narrow band, not joined ventrally, each with a membranous appendage at apex.

### Cyrtusa luggeri Hatch.

*Anogdus luggeri* Hatch, 1927, Univ. Minn. Agr. Exp. Stat. Tech. Bull. 48, 17.

Length 1.4-2.3 mm. Pale yellow to red. Second and third antennal segments equal in length. Punctures of the pronotum quite evident; those of the ely-

tral intervals conspicuous, moderately close, finer than the strial punctures but coarser than those of the pronotum. Metasternum polished; the punctures fine at middle, moderately coarse and close on the sides. Abdomen indistinctly and very finely punctulate.

*Male.* Anterior and middle tarsi feebly enlarged, the latter not quite as stout as the posterior tarsi. Middle tibia arcuate and with the inner apical angle produced into an elongate process as in *Neocyrtusa.* Lower condyle of posterior femur with an acute tooth at apex; the tooth broad at base. Aedeagus as figured.

The type of this species was taken in Minnesota. I have a large number of specimens from Michigan; Aylmer, Que.; Mer Bleue (near Ottawa), Arnprior, and Leamington, Ont.; Aweme, Man.; Saskatoon, Sask.; and Summerland, B.C. The secondary sexual characters of the male show some variation but are well developed in all specimens.

My identification of this species is based on a comparison of specimens with the type by Dr. C. E. Mickel and Mr. H. K. Dodge. They have found the antennal and mesosternal characters as described above and have referred my specimens to *luggeri* with confidence.

### 5. **Caenocyrta** n. gen.

Body slightly more convex, the form otherwise as in *Neocyrtusa.* Head with antennal grooves beneath, otherwise as in *Neocyrtusa.* Antenna of ten segments, with a compact, four-segmented club, as in *Neocyrtusa* but with the club more compact and with the reduced segment of that genus lacking. Prosternum carinate before the coxae. Mesosternum not carinate. Abdomen with six distinct segments. Tibiae rather slender.

*Male.* Secondary characters as in *Neocyrtusa* and *Cyrtusa.* Aedeagus with the median lobe moderately arcuate, flattened at apex; median orifice transverse, with a long free lobe on each side dorsally. Lateral lobes joined dorsally by a very narrow band, not joined ventrally, each with a membranous appendage at apex.

Type species—*Amphicyllis picipennis* Lec.

### **Caenocyrta picipennis** Lec.

*Amphicyllis picipennis* Lec., 1863, Smithson. Misc. Coll. No. 167, 25.

Length 1.3-2 mm. Pale yellow to red; the head and pronotum usually darker, usually blackish. Second antennal segment a trifle longer than the third. Punctures of head and pronotum distinct; those of the elytral intervals moderately close, quite fine but almost or fully as large as those of the striae, the latter frequently scarcely traceable. Metasternum polished, the punctures fine, moderately close. Abdomen indistinctly alutaceous, each segment with a row of very indistinct punctures across the middle.

*Male.* Anterior and middle tarsi feebly enlarged. Middle tibia arcuate, the inner apical angle produced into a slender process. Lower condyle of posterior femur produced into a triangular tooth; the tooth very broad at base, acute at apex. Aedeagus as figured.

The type of the species is a male from northern New York. The specimens before me are from New York; District of Columbia; Aylmer, Duparquet, and Brome, Que.; Mer Bleue (near Ottawa), Hawthorne, Simcoe, and Arnprior, Ont.; Summerland and Oliver, B.C. The secondary sexual characters show little

variation in the ten males at hand. Males of this species are very rarely found in the Ottawa region; our series of more than one hundred specimens from the district includes only a single example of that sex. Males are numerous in the smaller series from the District of Columbia and British Columbia.

### 6. **Apheloplastus** n. gen.

Body strongly convex, the greatest width a trifle more than seven-tenths the length; the form less elongate but otherwise as in *Caenocyrta*. Head slightly less than three-fifths as wide as the pronotum, the latter two-thirds as long as wide; the head with antennal grooves beneath, each groove feebly limited on the outer side. Antenna of ten segments; with a compact, four-segmented club; the form as in *Caenocyrta*. Prosternum finely carinate before the coxae. Mesosternum not carinate. Abdomen with six distinct segments. Middle and posterior legs with the tibiae very broad and the tarsi compressed.

*Male*. Anterior and middle tarsi and posterior femora modified; the middle tibia straight and not produced at apex, as in the female. Aedeagus with the median lobe moderately arcuate, flattened dorso-ventrally except at base; the median orifice transverse, with a small articulated lobe on each side. Lateral lobes joined together ventrally by a very narrow band, not joined dorsally. Internal sac with a long rod-like structure as figured.

Type species—*Cyrtusa egena* Lec.

### **Apheloplastus egenus** Lec.

*Cyrtusa egena* Lec., 1853, Proc. Ac. Nat. Sci. Phila. VI, 284.
*Cyrtusa impubis* Zimm., 1869, Trans. Am. Ent. Soc. II, 251.

Length 1.2-1.7 mm. Pale red or reddish-yellow. Second antennal segment longer than the third. Punctures of the pronotum and elytral intervals very fine, indistinct. Metasternum indistinctly alutaceous on the sides, the punctures fine, close. Abdomen very finely and indistinctly punctulate.

*Male*. Anterior and middle tarsi very feebly enlarged. Posterior femur at apex produced into a long, slender, very acute tooth. Aedeagus as figured.

The femoral tooth is longer and slightly curved in large males but is well developed in all. I have seen a large number of specimens from the District of Columbia; Michigan; Aylmer, Que.; Mer Bleue (near Ottawa), Arnprior, and Simcoe, Ont.

The type came from Habersham Co., Ga. Zimmermann described his *impubis* from North Carolina and recorded it from the District of Columbia in his description. The Leconte collection contains no specimens from North Carolina, and the specimen labelled there as the type of *impubis* is from the District of Columbia. The synonymy given above is based on this specimen and follows Horn. The species resembles *Isoplastus fossor* Horn very closely, but the two may be distinguished readily by the character of their antennal clubs. Horn's figure of the male posterior leg of *egenus* is inaccurate; the figure should show the femur widened apically and the tarsus considerably longer than the width of the tibial apex.

### 7. **Isoplastus** Horn.

*Isoplastus* Horn, 1880, Trans. Am. Ent. Soc. VIII, 295.

Body short and strongly convex; its form as in *Apheloplastus*. Head large, two-thirds as wide as the pronotum, the latter two-thirds as long as wide. Head with antennal grooves beneath, each groove limited on its outer side by a

short but strong carina. Antenna of ten segments; the club compact, larger than in *Apheloplastus,* three segmented; the seventh segment strongly transverse but much narrower than the eighth. Prosternum carinate before the coxae. Mesosternum not carinate. Abdomen of six distinct segments. Middle and posterior legs with the tibiae very broad and the tarsi compressed, as in *Apheloplastus* but with the tibiae slightly wider.

*Male.* Anterior and middle tarsi and posterior femora modifed; middle tibiae not modified. Aedeagus bent almost at a right angle; the median lobe flattened dorso-ventrally except at base, not deeply incised at apex, feebly sclerotized at base; the median orifice transverse; lateral lobes forming a ring at base, this interrupted both dorsally and ventrally; internal sac with a single long rod.

Type species—*Isoplastus fossor* Horn.

### **Isoplastus fossor** Horn.

*Isoplastus fossor* Horn, 1880, Trans. Am. Ent. Soc. VIII, 295.

Length 1.2-1.7 mm. Reddish yellow. Second antennal segment twice as long as the third. Punctures of the pronotum and elytral intervals very indistinct. Metasternal sides alutaceous, moderately, coarsely and closely punctate. Abdomen alutaceous, the basal segment with close, feebly impressed punctures, each of the other segments with a row of very indistinct punctules across the middle.

*Male.* Anterior and middle tarsi feebly enlarged. Lower condyle of posterior femur produced into a tooth at apex; the tooth strongly curved, slender, and very acute in large specimens, broad, short, and obtusely rounded at apex in small individuals. Aedeagus as figured.

I have five specimens from Aylmer, Que., and Arnprior, Ont. Horn's types were from Detroit, Mich., and the District of Columbia.

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## NOTES ON NORTH AMERICAN AGELENID SPIDERS.

BY IRVING FOX,
Washington, D. C.

The material on which the following paper is based is deposited in the United States National Museum to whose authorities I am indebted for the privilege of studying the collections of spiders in their charge. Several colleagues have been very generous in lending material and in giving advice. Particular thanks are due to Miss Elizabeth B. Bryant of the Museum of Comparative Zoology, Dr. W. J. Gertsch of the American Museum of Natural History, and Professor R. V. Chamberlin of the University of Utah.

FAMILY AGELENIDAE

### **Cybaeus sinuosus** n. sp.

Figs. 1, 2.

*Female.*—Total length, 7.62 mm. Carapace, 3.37 mm. long, 2.45 mm. at the widest place, 1.48 mm. wide in front. Abdomen, 4.55 mm. long, 3.27 mm. wide, Resembling *C. patritus* Bishop and Crosby in the structure of the epigynum but larger in size and lighter in color. Carapace light brown above without distinct markings, pars cephalica noticeably darker than the pars thoracica. Sides of the carapace with narrow marginal dark bands. Chelicerae and clypeus dark reddish brown. Sternum and coxae clear yellowish brown, the labium and endites

darker. Legs light brown without annulations, lighter below than above. Dorsum of the abdomen light gray with four or five indistinct dark chevrons posteriorly. Sides of the abdomen and venter concolorous with the dorsum. Anterior spinnerets approximated.

First row of eyes slightly recurved, the medians separated from each other by more than a diameter, from the laterals by less than a diameter and much smaller than the latter. Second row of eyes straight, wider than the first (29/25), the medians closer to the laterals than to each other and slightly smaller than these. Median ocular area wider than long (14/11), narrower in front than behind (10/14). Clypeus more than twice as high as the diameter of an anterior median eye. Chelicerae robust, 1.58 mm. long, lower cheliceral margin armed with three robust teeth and two or three small denticles, upper margin armed with three large teeth. Tibiae and metatarsi of legs I with 2-2-2 spines below, the last pair apical. Legs I, 10.59 mm. long (coxae and trochanters, 1.48 mm.; femora, 2.18 mm.; patellae and tibiae, 3.56 mm.; metatarsi and tarsi, 3.37 mm.). Legs II, 10.29 mm. long (coxae and trochanters, 1.29 mm.; femora, 2.47 mm.; patellae and tibiae, 3.07 mm.; metatarsi and tarsi, 3.46 mm.). Legs III incomplete. Legs IV, 11.19 mm. long (coxae and trochanters, 1.39 mm.; femora; 2.28 mm.; patellae and tibiae, 3.56 mm.; metatarsi and tarsi, 3.96 mm.).

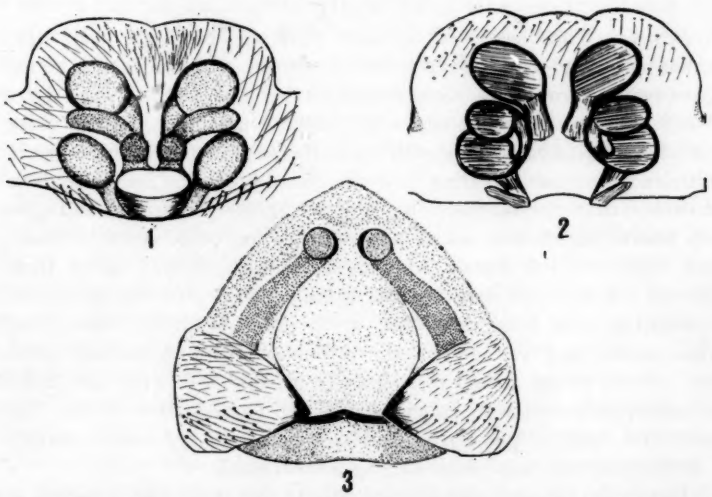


Fig. 1. *Cybaeus sinuosus*, n. sp. epigynum, ventral view. Fig. 2. *Cybaeus sinuosus*, n. sp., epigynum, dorsal view. Fig. 3. *Tegenaria praegrandis*, n. sp., epigynum.

*Type Locality*.—Canada: Female holotype from Fairview Mt., Alberta, between 8000 and 9000 feet, July 9, 1925 (O. Bryant, Collector). *Type*: U.S.N.M. Cat. No. 1254.

The epigynum of this new species greatly resembles that of *C. patritus* Bishop and Crosby. The details in which it differs from that of the latter species may best be appreciated by dissecting out the organ and examining it from the dorsal aspect. Figures 1 and 2 illustrate the structure of the epigynum from both the dorsal and the ventral views.

### Cybaeus reticulatus Simon.

*Cybaeus reticulatus* Simon, Ann. Soc. Ent. Belgique 30: LVI, 1886.

*Records.*—Alaska: Juneau, two females and two males, Sitka, five males and five females, Kukak Bay, female, Yakutat Bay, four females and several immatures, (Harriman Expedition, 1899, T. Kincaid, Collector); Yukon River, Nulato, May 16, 1867, female, (W. H. Dall, Collector); Unalaska, female and two immatures.

The material from Yukon and from Unalaska was labelled *Cybaeus borealis* Marx, a name which occurs in George Marx's list[1] of 1892 as representing a new and undescribed species. Inasmuch as the specimens were never described, the name *Cybaeus borealis* Marx has no status even as a synonym. The material that provided the basis for the name *Cybaeus algidus* Marx, also occurring in the paper referred to, was found to represent a species not in the family Agelenidae.

### Tegenaria derhamii (Scopoli)

*Aranea derhamii* Scopoli, Entomologia Carnicola exhib. Ins. Carn. indig. p. 400, Vindobona, 1763.

*Coelotes plumarus* Bishop and Crosby, Jour. Elisha Mitchell Sci. Soc., 41:200, Pl. 25, fig. 50, 1926.

The above synonymy was suggested by the late Professor C. R. Crosby on the occasion of the author's visit to him.

### Tegenaria praegrandis n. sp.

Fig. 3.

*Female.*—Total length, 13.96 mm. Carapace, 7.42 mm. long, 5.45 mm. at the widest place, 3.46 mm. wide in front. Abdomen, 7.42 mm. long, 4.16 mm. wide. Carapace reddish brown, the cephalic part darker than the thoracic; dorsum provided with a narrow median stripe which tapers caudad terminating in the dorsal groove. Pars cephalica well elevated above the pars thoracica, the latter with several transverse furrows radiating from the dorsal groove. Chelicerae dark brown, much darker than the carapace, the clypeus lighter. Sternum and coxae light reddish brown, labium and endites noticeably darker, with white terminal patches distally. Legs reddish brown without annulations, lighter below than above. Dorsum of the abdomen dark gray in ground color, provided with a light pattern consisting of a basal transverse mark which sends off three longitudinal branches caudad and four or five chevrons becoming progressively smaller posteriorly. Sides of the abdomen irregularly marked with gray and dark brown, venter yellowish brown with indications of two parallel dark bands. Spinnerets yellowish, the anterior pair broad and approximated, .49 mm. in length; distal joint of the posterior pair about as long as the basal.

First row of eyes slightly procurved, the eyes subequidistant with the median slightly smaller than the lateral. Second row of eyes procurved, wider than the first (25/20), the eyes subequal and equidistant. Median quadrangle about as long as wide, wider behind than in front (10/18). Clypeus equal in height to twice the diameter of an anterior median eye. Chelicerae robust, 3.46 mm. long, lower margin of the furrow armed with seven teeth of which the distal four are quite robust, upper margin armed with three teeth of which the middle is the largest. Tibiae of the first pair of legs with evidences of a basal and a submedian pair of spines. Legs I, 32.3 mm. long (tibiae and patellae, 9.20

[1]Marx, George, 1892, A Contribution to the study of the spider fauna of the Arctic regions, Proc. Ent. Soc. Washington, Vol. II, No. 2, p. 190.

mm.). Legs II, 27.6 mm. (tibiae and patellae, 7.92 mm. long). Legs III, 26.4 mm. long (tibiae and patellae, 6.93 mm.) Legs IV, 34.6 mm. long (tibiae and patellae, 9.20 mm.).

Epigynum wider than long, more or less triangular in shape, posteriorly an acuminate lamellated process extends mesocaudad from each corner. For further details of the structure of the epigynum see Fig. 3.

*Type Locality.*—Washington, D.C.: Female holotype from "D.C. Dept. Grounds, Hothouse, outside" (Marx's catalogue). *Type*: U.S.N.M. Cat. No. 1255.

This new species seems to bear no close relationship to any other North Amercian member of its genus; it may be readily distinguished by its large size and unusual epigynum.

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## THE LAUDABILIS GROUP OF LACINIPOLIA (LEPID., PHALAENIDAE)*.

BY J. MCDUNNOUGH,
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The species of the *laudabilis* group, formerly included in the Hadenine genus *Polia* but now placed in the recently erected genus *Lacinipolia* McD., have always proved more or less of a stumbling block to taxonomists. Variation in the individual species, combined at times with a certain amount of sex-dimorphism, has been partially responsible for the confusion, which of late years has been increased by the addition of certain of Strand's names, based on Hampson's so-called "aberrations," and other names proposed in a varietal sense by Draudt for Mexican forms in the American Noctuid portion of Seitz' Macrolepidoptera of the World.

In a revision of this group which I have undertaken during the past few months I have been greatly assisted by Mr. W. H. T. Tams of the British Museum who has most kindly furnished photographs of type specimens and their genitalia. Furthermore through the courtesy of the authorities of the United States National Museum I have been enabled to work over their entire material in the group, which has included *Paratypes* of four of Draudt's so-called varieties. This very considerable number of specimens, combined with what is present in the Canadian National Collection and certain other material received from Dr. J. Comstock of Los Angeles, Calif., has permitted me to arrive at, I believe, a fairly accurate evaluation of the various species. In the course of the study it has been found that the genitalia, both male and female, present excellent specific characters and it is largely on the structure of these organs that my separation into species has been based. Before proceeding to a discussion of our North American species proper I might mention that both *egestosa* Draudt and *suda* Draudt prove to be good species, not as yet recorded from the south-western States; *lunata* Draudt seems to be a direct synonym of *mediosuffusa* Strand, a form of *laudabilis* with the median area, except above inner margin, strongly suffused with deep brown; *lichenea* Draudt, of which only a female Paratype was available for study, appears also to be a well-marked form of *laudabilis*, occurring occasionally

*Contribution from the Division of Systematic Entomology, Entomological Branch, Department of Agriculture, Ottawa.

in Texas. Three other of Draudt's Mexican forms, viz. *scribillata* from Cuernavaca, *conspersa* from Tehuacan and *y-nigrum*, have not as yet been placed, but, judging by the figures, do not seem to conflict with any United States species. One other name, *strigicollis* Wall., remains a puzzle. The species was briefly described in Latin from Californian material and the type stated to be in Stockholm; correspondence years ago with Professor Aurivillius elicited the statement that it could not be located in the Stockholm Museum; Hampson makes the name a synonym of *laudabilis* and Draudt treats it as a distinct species, occurring in Colorado, Utah and Arizona, without, however, giving any figure; it seems likely that he has applied the name to a form of *illaudabilis* commonly occurring in these States. The original diagnosis does not seem to fit in well with any species in the group under discussion and the correct identity must remain for the present a mystery.

*Lacinipolia laudabilis* Gn. The species is common in the Gulf States and extends northward at least as far as N. Carolina and Arkansas; Hampson's figure is fairly accurate. *Indicans* Wlk. is correctly listed as a synonym; *rufoirrorata* Strand is a form with ruddy shading between the spots in the median area and *mediosuffusa* Strand, as already noted, has heavy dark shading in the median area above vein 1; the name is based on a female from Jalapa, Mexico, but similar specimens occur in the United States. The male genitalia (fig. 1) are quite characteristic; the long thin spine projecting from the apex of the aedeagus being a noticeable feature.

*Lacinipolia marinitincta* Hart. A rather small species of about 25 mm. in wing expanse described from Bosque Co. Texas, topotypical specimens being in the United States National Museum. Hampson's figure is a fair representation of the female, although somewhat too purplish. The male is paler greenish-gray in color of primaries with closely approached t. a. and t. p. lines above inner margin; the secondaries are pale hyaline in basal half. Our only Texas specimens are from Kerrville, taken in September and October; a single male from Paradise, Ariz. (Aug., 1924) and another one from Texas Canyon, Ariz (Sept.) belong here on genitalic characters. Compared with the Texan specimens they show more contrasted maculation and appear less washed-out on the primaries; this is largely due to the fact that the median area is more intensely shaded with purple-brown with in consequence better defined border-lines, which, further, are rather wider apart than in the type form. For this apparent race the varietal name APPENDICULA may be used. In the male genitalia (fig. 2) the aedeagus is armed apically, with a short, stout, bent hook and there is no pollex projecting from below the harpe as in *laudabilis;* the uncus has the apex curved upward.

### **Lacinipolia implicata** n. sp.

*Male.* Palpi white, suffused with blackish outwardly on joints 1 and 2. Antennae faintly ciliate. Front, collar and thorax largely greenish-white, the former with a black spot next each eye, the collar with a black transverse, subapical band, and the thorax with slight black sprinkling and a black border to lower edge of the patagia. Abdomen deep gray. Primaries concolorous with thorax, being a pale whitish green (in fresh specimens light green) with the median area strongly suffused with purplish brown. Basal half-line black, excurved in the cell and connected to base of wing by a short dash; below and

slightly beyond it a short black streak. Antemedian space broad, pale, with two dark costal spots. T. a. line black, outwardly oblique, bulging somewhat inwardly in cell, then gently excurved to middle of inner margin with a faint inward angle on vein 1. T. p. line marked by two dark spots on costa, well excurved around reniform, then *inwardly oblique to a point on inner margin very close to t. a. line;* it is marked on the veins by short teeth and shows a fairly prominent inward scallop between veins 1 and 2. Median space largely shaded with purple-brown, showing traces of a lighter, almost ruddy-brown between the orbicular and reniform. Orbicular a small round pale spot, reniform, upright, scarcely constricted, pale, partially outlined in black, claviform obsolescent. S. t. line arising from a dark oblique dash on costa, obsolescent, only indicated by intravenular dark spots or dashes, faintly outlined outwardly in white. Subterminal and terminal spaces entirely pale. Fringes pale, cut by a double series of median and terminal dark spots. Secondaries pale whitish at base, otherwise deep smoky, crossed by a fairly obvious, irregularly angled median line. Fringes pale, cut by a slightly scalloped median line. Beneath primaries suffused with smoky with traces of a dark postmedian line and pale fringes as above. Secondaries whitish, sprinkled with smoky, especially along costa and outer margin; a distinct dark discal dot and an irregular, dark, postmedian line. Fringes as above. Expanse 28 mm.

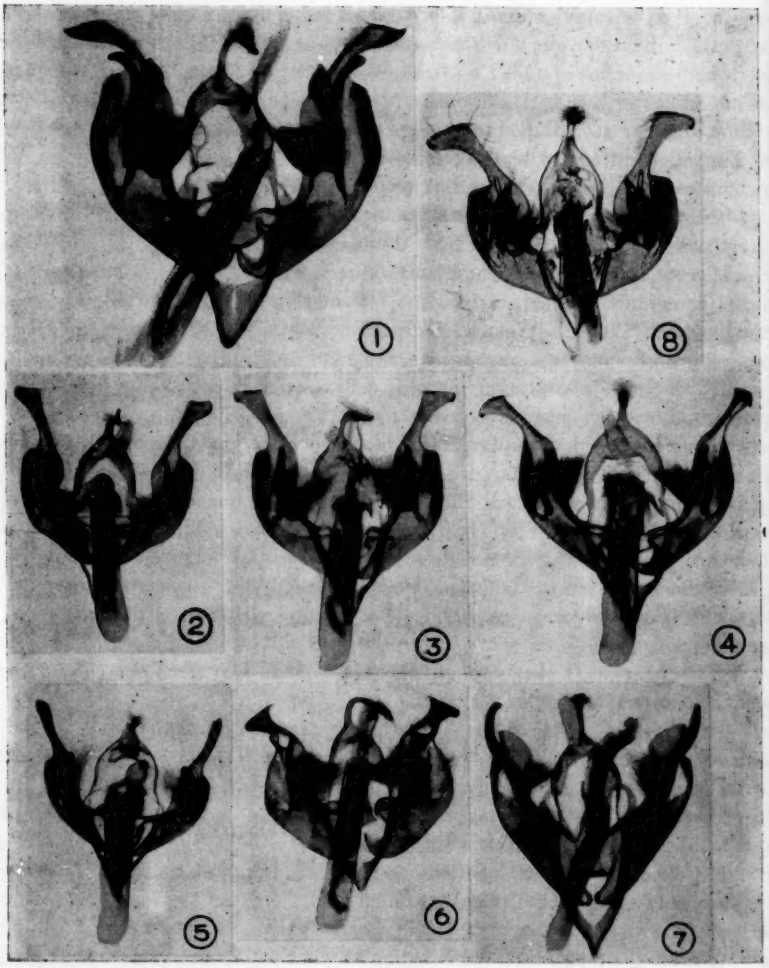
*Female.* Considerably deeper in color and more heavily marked with blackish than the ♂. The thorax centrally shows more black sprinkling; the median area on primaries is very dark and the t. a. and t. p. lines are not so closely approached on inner margin. The dark spots or arrow-marks defining the s. t. line inwardly are quite heavy and there is a distinct, dark, oblique shade above anal angle, connecting the s. t. line with the outer margin. The secondaries are entirely deep black-brown on upperside and heavily sprinkled with same color on underside.

*Holotype*—♂, Lakehurst, N. J., Sept. 4, (F. Lemmer); No. 4241 in the Canadian National Collection, Ottawa.

*Allotype*—♀, Black Mts., N. C., Sept. 15, (Beutenmuller), (ex Coll. Wolley Dod), in the Canadian National Collection, Ottawa.

*Paratypes*—1 ♂, Lakehurst, N. J., Sept. 10, (F. Lemmer); 1 ♂, Knoxville, Tenn., Sept. 11, 1928; 1 ♂, Black Mts. N. C. (Beutenmuller); 4 ♀, Black Mts., N. C., Sept. 10, March 18 (Beutenmuller). All these in the Canadian National Collection, Ottawa. 3 ♂, Ramona, Mich., Aug. 20, 24 in Coll. Comstock, Los Angeles, Calif. 1 ♂, Texas; 2 ♂, Clarksville, Tenn., Sept. 23, Oct. 11; 1 ♀, Southern Pines, N.C., Oct. 1-7 (Coll. Barnes); 2 ♂, 1 ♀, Plummer's Is. Md., Aug. 31, Sept. 4, 5; 3 ♂, 2 ♀, Washington, D. C., Sept. 6, 8, 21; 3 ♂, New Brighton, Pa., Sept. 1, 5, 14 (H. D. Merrick) (Coll. Barnes). All in the United States National Museum.

This species has been confused with *laudabilis* Grt. and is figured by Holland (Moth Book, Pl. XXIV, fig. 1) under this name; it may be separated in the male sex by the close proximity of the t. a. and t. p. lines on inner margin and in the female sex by the entirely dark hindwings. It is very close to *marinitincta* Harv. in maculation but the size is much larger; according to the male genitalia (fig. 3) it belongs in this group, having the aedeagus armed apically with a bent hook-like spine; from *marinitincta* it differs in the thicker median




Male genitalia of 1. *Lacinipolia laudabilis* Gn. (Hope, Ark.); 2. *L. marinitincta* Harv. (Kerrville, Tex.); 3. *L. implicata* n. sp. (Holotype); 4. *L. explicata* n. sp. (Hollotype); 5. *L. tricornuta* (Peach Spgs. Ariz.); 6. *L. viridifera* n. sp. (Paratype); 7. *L. consimilis* n. sp. (Holotype); 8. *L. illaudabilis* Grt. (Stockton, Ut.).

portion of uncus with apex less upcurved, the broader and longer harpe and the longer and stouter aedeagus.

**Lacinipolia explicata** n. sp.

*Male.* Palpi whitish, shaded heavily on outer sides of first and second joints with blackish. Front whitish with black spot next each eye. Antennae feebly ciliate. Collar an admixture of white, olive-green and brown scaling, crossed by a black band near apex. Thoracic vestiture largely olive-brown centrally, with patagia and posterior tuft mostly pale, whitish, the former with black border next wing-base. Abdomen smoky-brown. Forewings with the pale greenish-white ground color largely suffused with olive-brown and black-brown, except in the area beyond the t. p. line where the pale color is predominant and quite contrasting. Basal half-line slightly waved, bordered rather broadly outwardly with white and connected by a short dark streak with base of wing; below it a faint blackish patch extends to inner margin. T. a. line black, rather rigidly outwardly oblique with slight inward angles below costa and on vein 1; bordered inwardly with white. The broad antemedian space between basal and t. a. line shaded with light olive-brown, intermingled with pale greenish scaling. T. p. line black, with narrow outer white border, well bent out around reniform and then rather rigidly inwardly oblique to inner margin, finely dentate on the veins. Almost the entire median space, except along costa is heavily suffused with olive or blackish-brown, obscuring the ordinary spots and making this section of the wing darker than the surrounding portions. Claviform a short black loop; orbicular moderately large, round, outlined with black; reniform oval, scarcely constricted, outlined in black, filled with darker scaling in which there is a slight ruddy tinge. On costa beyond t. p. line is a dark patch occupying half the distance to apex of wing and containing three white points on costal edge; balance of s. t. and terminal spaces pale, with faint greenish tinge; s. t. line only traceable as faint dark dots. *Above anal angle a broad oblique, dark streak extends from outer margin almost to t. p. line.* Fringes pale, checkered with dark. Secondaries whitish, faintly shaded with smoky on inner margin above anal angle and broadly smoky along outer margn, this border narrowing towards anal angle and disappearing before reaching same. Fringe white, cut by a slightly waved dark line. Beneath primaries largely shaded with smoky, with traces of a dark postmedian line; inner margin broadly whitish; fringes as above. Secondaries white with smoky sprinkling along costa and costal half of outer margin; a distinct dark discal dot and a postmedian line, best defined in costal portion of wing. Expanse 28 mm.

*Female.* Maculation as in male but on the primaries the dark suffusion, especially in median area, tends to become considerably deeper, extending at times across the antemedian space to base of wing. Secondaries very similar to those of the male with possibly slight extension of the dark area. Expanse similar to that of male.

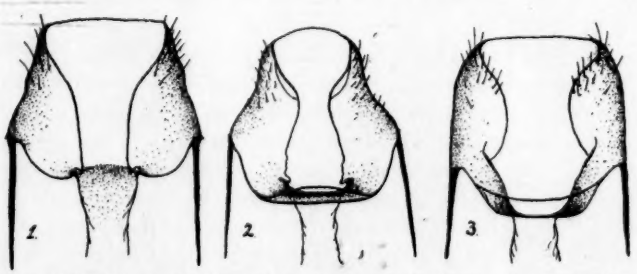
*Holotype*—♂, Kerrville, Tex. (ex Coll. Barnes), in United States National Museum.

*Allotype*—♀, Arkansas, No. 4240 in Canadian National Collection (ex Coll. Wolley-Dod).

*Paratypes*—1 ♂, Kentucky (1.IX.99) (ex Coll. Barnes); 1 ♂, Clarksville, Tenn. (24.IV.1914); 1 ♀, Texas (Belfrage) (Coll. C. V. Riley); 1 ♀, Kerrville, Tex. (Coll. Barnes); 1 ♀, Kentucky (Sept. 5, 1899) (Coll. Barnes); 1 ♀, Kentucky (Coll. Barnes); 2 ♀, N. Carolina. All in the collection of the United States National Museum except the first-named male and the second female which are in the Canadian National Collection through the courtesy of the authorities of the United States National Museum.

On genitalic characters the species is allied to *marinitincta* Harv. but, apart from generally much larger size of the organ, the bent hook which forms the apical armature of the aedeagus (fig. 4) is twice as long and the harpe considerably broader and chunkier, especially basally. There is further a spined area on the aedeagus apically, on the side opposite to the above-mentioned hook, which is not present in *marinitincta*.

*Lacinipolia runica* Hamp. The name is based on a single female from Palmerlee, Ariz. and a photograph of this type is before me. I have found a single topotypical female amongst the United States Museum material which matches this photograph excellently. As far as can be told at present the species is characterized in the female by the lack of dark shading in the median area of primaries and by the close approximation of the t. p. line to the reniform. The genital plate (text fig 2) presents sufficient distinctions from that of other Arizona species to warrant the supposition that we are dealing with a distinct species.




Female genital plate of 1. *L. viridifera* n. sp.; 2. *L. runica* Hamp. 3. *L. consimilis* n. sp.

**Lacinipolia viridifera** n. sp.

*Male*. Palpi whitish, heavily shaded with blackish outwardly. Antennae feebly ciliate. Front, collar and thorax light green (color fades to whitish in relaxed specimens) with black dots next the eyes, a partial black band across the collar, some blackish sprinkling on patagia next wing-base and two small black patches of scales lateroposteriorly on thorax. Abdomen light gray. Primaries even light green, with very faint darker shades on costal portion of median area. Basal half-line black, composed of a vertical streak on costa and a detached L mark connecting with base of wing, beyond which in antemedian area is a small black patch. Inner margin at base faintly smoky. Antemedian area pale green with traces of a faint dark streak along costa and a very small but distinct black dot in cell half way between basal and t. a. lines. T. a. line black, arising from a slightly enlarged spot on costa, almost vertical to below cell, then quite strongly excurved and again vertical to inner margin, faintly edged inwardly with whitish.

Median area with slight dark shading in costal area, especially between reniform and t. p. line, also two black costal spots, otherwise pale green. *Orbicular minute, circular,* outlined in black with pale green filling; reniform upright, broad, slightly constricted centrally, whitish-green, strongly outlined in black below and on outer side, less so on inner side and open toward costa; claviform absent. Inception of black t. p. line represented by a dark spot on costa above reniform; this line is obsolescent in costal portion, well defined from below radial vein, subparallel to outer edge of reniform and slightly concave, forming a blunt angle on vein 5 and then strongly incurved but not markedly dentate, touching base of reniform and parallel to t. a. line above inner margin; faint white outer edging. S. t. line faint, whitish, arising from small dark subtriangular patch on costa, convex to above anal angle where it forms a rather sharp inward angle, the space between this angle and outer margin being filled with blackish; faint black shading outwardly opposite cell. Fringes pale with double rows of black, basal and apical spots. Secondaries pure hyaline-white, with white fringes. Beneath primaries white with smoky subtriangular patch on costa before apex, preceded by the commencement of a smoky postmedian line; secondaries immaculate, white. Expanse 23 mm.

*Female.* Differs considerably from the male in that the whole median area of primaries except costa above reniform is heavily and almost uniformly shaded with purple-brown, in which the pale orbicular and reniform stand out very strongly and the claviform is usually present as a small, pale-filled loop. The t. a. line usually shows a fairly strong inward angle on vein 1. The secondaries are light smoky, fading to whitish at extreme base and the fringes are cut by a faint, smoky, median line; beneath they show a dark discal dot, an irregular postmedian line, and terminal smoky shading.

*Holotype*—♂, S. Fork Cave Cr., Chiricahua Mts., Ariz. May 24, 1934 (G. & J. Sperry); No. 4242 in the Canadian National Collection, Ottawa.

*Allotype*—♀, Huachuca Mts., Cochise Co., Ariz. June 1, 1910 (V. L. Clemence) (ex Coll. Wolley-Dod) in the Canadian National Collection, Ottawa.

*Paratypes*—5♂, 5♀, same data as Allotype, May 22, 26, June 1, 6, 9. in the Canadian National Collection (one ♂ to be deposited in the United States National Museum), 6♀, Huachuca Mts., Ariz.; 2♀, Redington, Ariz.; 2♀, Palmerlee, Ariz.; 1♀, Chiricahua Mts. Ariz.; all in the United States National Museum, ex Coll. Barnes.

The males are readily recognized by the even pale green color of primaries and the immaculate white secondaries; the females are at times difficult to distinguish from those of the following species but in general can be separated by the minute orbicular and the paler color of secondaries. In the male genitalia (fig. 6) the claspers are short and chunky and a pollex is present as well as the harpe; the aedeagus is unarmed apically.

**Lacinipolia consimilis** n. sp.

*Male.* Palpi white, heavily shaded with blackish outwardly. Antennae feebly ciliate. Front, collar and thorax creamy (in fresh specimens there may be a greenish tinge) with dark spots next the eyes and traces of a dark line across collar. The anterior thoracic tuft is heavily shaded with blackish, the lateral edges of the patagia are broadly blackish and on both sides of the posterior

thoracic tuft there are patches of blackish hairs. Abdomen deep brown. Primaries pale creamy with a slight greenish tinge (probably more pronounced in fresh specimens); maculation practically the same as in the preceding species but *the median area is strongly suffused with purple-brown* as in the female, the *orbicular* is distinctly *larger* and irregularly oval, the two spots on costa in antemedian area are more prominent and not connected (or rarely so) by a streak and the dark spots and arrow-marks before the s. t. line are intensified and more or less connected to form an irregular dark line, although the oblique dark streak in terminal area above anal angle is practically wanting. The secondaries are pale smoky, slightly hyaline at base and shading to deeper smoky outwardly. Fringes pale, cut by a faint smoky line. Beneath primaries light smoky with pale checkered fringes; secondaries faintly smoky, more heavily sprinkled with dark along costa and at apex; a faint discal dot and traces of a postmedian line. Expanse 23 mm.

*Female.* Very similar to male but rather more heavily shaded with brown and with the subterminal brown markings intensified. The secondaries are more or less *evenly dark smoky* and the underside is more heavily shaded.

*Holotype*— ♂, Huachuca Mts., Ariz. (ex Coll. Barnes) in the United States National Museum.

*Allotype*— ♀, same data.

*Paratypes*—4 ♂, same data; 2 ♂, 2 ♀, Redington, Ariz. (Coll. Barnes); 2 ♀, Santa Catalina Mts., Ariz., Sept. (Coll. Barnes); 1 ♂, 1 ♀, Arizona, July, (Coll. O. Poling). All from the United States National Museum, 2 ♂, 1 ♀, being retained in the Canadian National Collection, Ottawa, 1 ♀, Douglas, Ariz. (Aug.); No. 4243 in the Canadian National Collection.

One male genitalic characters (fig. 7) the species is very distinct from the preceding, being easily recognizable by the broad, flat, strongly projecting harpe, the practical lack of the usual trigonate cucullus and the longer and thinner aedeagus.

### **Lacinipolia tricornuta** n. sp.

*Male.* Palpi white, shaded heavily with blackish outwardly. Antennae feebly ciliate. Front and collar white with traces of the usual blackish spots next eyes and blackish line across collar; thorax largely white, sprinkled sparsely with black and with the patagia edged laterally rather feebly with black; posterior thoracic tuft creamy with traces of black lateral edging. Primaries white, suffused with creamy, the pure white color showing as edging for the transverse lines. Basal area marked as usual with black much as in *consimilis;* t. a. line black, straight below costa, gently rounded outwardly below cell, angled inward on vein 1 and then outwardly oblique to inner margin. Median space suffused with rather pale purplish, this color extending to level of claviform, below which the color is largely creamy olive; orbicular a minute pale dot, circled by black; claviform a small black loop, pale-filled; reniform broadly U-shaped, pale, widely open toward costa, otherwise outlined with black. T. p. line well exserted around reniform, black, edged outwardly with white, noticeably dentate on veins and with the usual large scallop above vein 1. Beyond t. p. line a darkish costal shade to near apex, containing three pale dots. S. t. line indicated, especially in lower half, by irregular white markings, edged inwardly with smoky and with the

usual smoky oblique shade connecting it with anal angle. Fringes checkered. Secondaries white, with very faint trace of smoky shading at apical angle, extending on to fringes. Beneath white, with faint smoky shades through cell of primaries and a rather large dark discal dot on secondaries. Expanse 25 mm.

*Holotype*—♂, Peach Spgs., Ariz., May 30, 1934, (G. & J. Sperry); No. 4249 in the Canadian National Collection, Ottawa.

Very similar in appearance to a pale *illaudabilis* but best distinguished by the broader, open reniform. The genitalia (fig. 5) are quite distinct, the aedeagus being armed apically with a cluster of three stout cornuti; the harpe is broad and slightly scoop-shaped and there is no pollex.

*Lacinipolia illaudabilis* Grt. A wide-spread species occurring along the entire Pacific slope from British Columbia to San Diego, Calif.; it is also common in Colorado, Utah and sections of Arizona. The name *alboguttata* Grt., with *restora* Sm. as a synonym, may be used for the more heavily marked form from the northern Pacific States and British Columbia; the former name was based on material from Oregon and Smith's type material came from Kaslo, B. C. A photograph of Grote's female type before me seems to match quite well with specimens in our Kaslo series and I hardly believe that both names are required; I have already commented on these names in the Canadian Entomologist, 1927, Vol. LIX, p. 208. The male genitalia (fig. 8) show a harpe with broad base, narrowing apically to a blunt point, beneath which arises a narrow finger-like pollex; the aedeagus is armed apically with a semi-rectangular chitinous patch containing a number of minute spines.

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## NOTES ON THE BIOLOGY OF MICROPLECTRON FUSCIPENNIS ZETT. AS A COCOON PARASITE OF DIPRION POLYTOMUM. HARTIG.

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The results of a three year study of the imported parasites of *Diprion polytomum* show that an eulophid parasite, *Microplectron fuscipennis* Zett., gives promise of becoming an important control factor of the spruce sawfly in Canada. *M. fuscipennis* is widely distributed in Europe, and its habits there have been fully discussed by Morris and Cameron (1935) and by Ullyett (1936). Since 1934 investigations of the biology of *Microplectron* have been conducted in the laboratory at Belleville, Ont., and in the field at Parke Reserve, Kamouraska County, P. Q., where liberations of parasites were made in 1934 and 1935. In 1936 liberations of *Microplectron* were discontinued at Parke Reserve, as it was desired to determine if the parasite was capable of becoming established from the introductions of the two years previous.

Two generations and a partial third have been reared during the summer season at Parke Reserve. The emergence of adults of overwintering material commences the second or third week of June, and continues until the first of July. The earliest date recorded was in 1936, when cocoons, which were collected late in May, produced *Microplectron* adults on June 8th. In 1935 second generation adults of reared material emerged from July 20 to 30th, and third generation adults started to appear on August 19th. Second generation adults

in 1936 emerged from July 15th to August 15th. Development in 1936 was retarded by a cold midseason, the mean temperature for July and August being only 58.3 degrees F., consequently, only a few third generation adults emerged, the first appearing on September 15th. While there are only two or three generations of adults in the field each year, there is considerable overlapping, resulting in the continuous presence of adults from about the second week of June until October.

A single parasite emergence hole is made on the exposed surface of the cocoon. When a cocoon contains both male and female adults the emergence hole is usually cut by a female. The males can likewise cut a hole, unless the cocoons are exceptionally dry and hard. Under laboratory conditions up to 100 adults have emerged from a single host cocoon; field-collected cocoons in Quebec produced a maximum of 95 *Microplectron* adults and the average number was 34.

Mating may take place immediately following emergence. The progeny of unmated females are males and mated females generally produce both males and females, the latter constituting about 91 per cent of the total progeny. A single mating is sufficient to fertilize a female, while a male is capable of mating with at least six females.

The preoviposition period is very short. An adult female may commence to pierce a host cocoon soon after emergence, regardless of whether or not mating has taken place. The cocoon is pierced with several holes before any eggs are laid. Six adults were timed and the periods required to puncture the cocoons were .5, 4, 12, 13, 24 and 38 minutes. It appears that the time required to drill holes increases directly with the dryness or hardness of the cocoon. Observations indicate that the sawfly larvae is partially paralyzed with the initial punctures, but paralysis is not always complete, and L. R. Finlayson, of the Dominion Parasite Laboratory, has noted that the host larvae in parasitized cocoons are often capable of ingesting a few of the *Microplectron* eggs. These eggs, which lodge in the crop of the larva, fail to hatch, due to mechanical injury. The number lost in this fashion is insignificant. The eggs are deposited loosely on the integument of the larva, prepupa, or pupa, according to which stage of the host happens to be in the cocoon at the time of attack. In the laboratory the maximum number of eggs laid by an adult was 215, though usually, with the temperature and relative humidity operating at about 80 degrees F. and 60 per cent respectively, the average number of progeny of various lots of adults was between 40 and 57, depending upon the handling of the material. Under field conditions 23 adults, each of which was provided with six sawfly cocoons, produced an average of 70 progeny, the numbers ranging from 0 to 132. Not more than four cocoons of each lot were parasitized. Oviposition in field cages has been observed at a temperature as low as 52 degrees F. The majority of the eggs are laid during the first half of adult life.

The incubation period is short during July and August. The average incubation period of one lot of eggs was 3.8 days, when the mean temperature was 60.5 degrees F., and that of another lot was 5.9 days when the mean temperature was 57 degrees F.

The larvae pass through five stages. With the mean temperature at 59.7 degrees F. the average larval period of females was 22 days. The pupal period of females averaged 24.3 days when the mean temperature was 56.5 degrees F. These temperatures were exceptionally low for the summer season, and the larval and pupal periods are generally much shorter. The period from oviposition to adult emergence averaged about 31 days and ranged from 26 to 50 days.

The longevity of adults varied from 6 to 47 days, while the average longevity of fed adults in cages was 31 days under Parke Reserve conditions. Reduced longevity was pronounced when on one occasion the temperature went to 92 degrees F. in 1935.

*Microplectron* hibernates in the last larval, prepupal, and pupal stages. Experiments have demonstrated that the egg and younger larval stages will not hibernate. The larvae hatching from eggs that were laid later than September 22nd in 1934, and September 15th in 1935, did not develop sufficiently to survive the winter, and eggs laid during the latter part of September succumbed to frost.

It is definitely known that *Microplectron* can withstand the rigorous winters of Quebec. Forty-three colonies of *Microplectron* adults were recovered from *Diprion* cocoons collected at Parke Reserve in the fall of 1935, and similar collections made in September, 1936, are, at the time of writing, beginning to produce adults of the parasites at Belleville, where the cocoons are being incubated. In spite of the hardy nature of this parasite, it should be remembered that *Microplectron* adults are not strong fliers, and crawling seems to be the chief means of locomotion, so, when liberations are made, some consideration should be given to optimum conditions for establishment. Experiments indicate that the parasite does best in an open stand, where the sun's rays can penetrate. This preference is coincidental with that of the host itself. Sawfly cocoons lying closest to the surface of the ground cover are more readily attacked by *Microplectron* than are cocoons covered with dense layers of moss or debris.

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## NEWS AND VIEWS

### AUTOGIROS AND CHEMICALS USED IN CAMPAIGN TO SAVE ELMS

"Silvicide"—a way to make unwanted trees kill themselves—and aerial scouting are new features of the campaign by the U. S. Department of Agriculture) to save American elms from extinction by Dutch elm disease, which has practically wiped out European elms.

Most elms condemned as possible sources of infection—more than three million all told—have been felled and burned. About 625,000 of these, however, were killed by the new treatment—"silvicide." This is done by peeling a band of bark from the tree at about breast height and placing over the exposed wood granulated copper sulphate, kept in place by a strip of oil cloth. Moisture from

the wood dissolves the copper sulphate, which, taken up by the sap, soon poisons the tree. This treatment has proved about 95 percent effective in killing banded trees. Hot, dry weather in July and August might even bring the kill up to 100 percent. Any trees hardy enough to survive the girdling and chemical injection will be felled and burned. Trees killed by silvicide are left standing for the owner to use when and as he sees fit.

Four autogiros scout inaccessible areas and railroad rights of way for diseased trees. Flying slowly just above the tree tops, trained observers readily spot wilted or discolored foliage—indications of the presence of the disease. They mark the location of every suspected tree on a map, later used to guide a ground crew to the spot.

Dutch elm disease came into the United States between 1925 and 1933 on burl elm logs shipped from Europe to cabinet makers in the Middle West. The fungus that causes the disease does not grow on the outside of elm trees. Its spores are not carried by the wind. It is spread by insects, particularly the small European bark beetle and the American elm beetle, which lay their eggs in shallow tunnels beneath the bark. The young beetle grubs feed on the wood around them, mature, and emerge to fly off to other elms, carrying with them disease spores, if the wood on which they fed was infected.

Objectives of the Federal eradication campaign, now in its fifth year, are (1) discovery and removal of every diseased tree as soon as possible after the first symptoms of infection—yellowing and wilting leaves and dying branches, which show up well in June and July; (2) removal of dead and dying elms, which are particularly attractive to bark beetles; (3) destruction in swamps and woods of wild elms that have no value and may harbor Dutch elm disease spores.

The disease is concentrated in a comparatively small area extending radially from New York City about 50 miles into Connecticut, New York State, and New Jersey. There have been a few isolated cases also in Maryland, Virginia, Indiana, and Ohio, and, beyond the major disease area, in Connecticut. No cure for the disease has been developed. The only hope for the American elm is to find every diseased tree and destroy it before the infection can be spread to healthy trees.

The results of the campaign thus far support the belief on which it was started—that Dutch elm disease can be eradicated from the United States, if the necessary man power and equipment are on hand at the right time. There must be enough trained scouts to find every diseased tree at the onset of the infection and enough well-equipped follow-up crews to destroy infected trees before the disease can spread from them to healthy elms.

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